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Do Rating Change Announcements Transfer Effective Information? Test on the Effectiveness and Sustainability of Credit Rating in China

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Abstract: China is commonly viewed as a country with weak legal institutions and disclosure regulations. The validity and effectiveness of credit rating in China are controversial topics. Bond ratings provide information about the quality and marketability of bond issues. This paper studies the effects of rating change announcements on the price of fixed-income enterprise bonds to test the effectiveness and sustainability of credit rating in China. The results show that upgrade and downgrade announcements have an asymmetric effect on bond prices. Downgrade announcements have transferred new information to the market, resulting in statistically significant negative effects, yet upgrade announcements do not have statistically obvious effects on bond prices. That the average cumulative abnormal returns two days before and on the day of the announcement are statistically insignificant implies that the rating information might not be leaked out before the announcement. The results indicate that the pricing function of credit rating has taken effect, and the effectiveness of the market has been improved over the years. The strengthening of regulations and supervision of the Chinese government toward the credit rating industry may help reinforce the sustainability of the industry and the bond market. The cross-sectional results suggest the market responses are more intense to unpredicted changes of ratings, and investors and portfolio managers should pay more attention to the bonds that have been downgraded for several levels from initial ratings.

Keywords: fixed-income enterprise bonds; credit rating; effectiveness; sustainability

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1. Introduction

China's bond market has grown significantly in recent years and is accelerating its internationalization process. It is now the second largest in the world, following the United States. China has made a great effort to open up its domestic bond market and pull in foreign investors' attention to the relatively high yields. It has become more open and attracted more interest from international investors, yet current academic attention toward China's bond market is still low.

With the fast expansion of China's bond market, it is becoming riskier, and the number of defaults is increasing. As an indicator of risk, bond ratings have played a crucial role in financial markets and are important for various market participants. Bond ratings are important for both firms and market participants because they provide information about the quality and marketability of various bond issues [1]. Information concerning corporate operations is often disseminated to market participants through the changes in bond ratings published by rating organizations [2]. Rating adjustments may also affect the desirability of a firm's bonds since they provide a signal to the market about the firm's long-term financial prospects [3].

Along with the development of the bond market, the China State Council established the rating system in 1987 during the period of China's 'Opening-up' policy and the market modernization from a traditional planned economy to a market economy [4]. Compared with the western rating industry, the Chinese credit rating industry is relatively young. There is a generally negative perception of the quality of Chinese bond ratings [5]. The

vast majority of Chinese bonds are rated AAA, AA+, and AA by credit rating agencies in China, which are about 6–7 notches higher than those by international CRAs on average [6], raising concerns and doubts about the accuracy of Chinese ratings [7,8] and implying a rating inflation issue [9]. Consequently, bond market participants suspect the credibility of ratings [10], and some critics dismiss Chinese CRAs as 'bereft of influence' [11].

According to the analysis of many researchers, the issuer-paid business model prevailing in China leads to rating inflation, less accuracy, and a conflict of interest [12–14], so CRAs have the incentive to give favorable ratings to issuers [15]. In addition, up to May 2017, the Chinese rating industry remained a restricted sector to foreign CRAs [4]. Barriers to entry into the credit rating industry by foreign CRAs and the emphasis on high ratings might have resulted in inflated ratings in China's credit market [16].

Like other emerging economies, China is commonly viewed as a country with weak legal institutions and disclosure regulations [17]. In order to regulate the rating industry, in 2006, the PBoC released instructions (No. YinFa [2006] 95) mandating one system of rating symbols and providing definitions of the symbols for use in the inter-bank market. Regulators also issued directives, such as NDRC circular No. [2012] 3451 and CSRC decree No. [2007] 50, aimed at minimizing the behavior of rating agencies deemed harmful, such as rating shopping and destructive competitive behavior [18]. China's tough approach in dealing with the major problems of its CRAs is intended to improve the performance of the domestic rating industry [4]. On the other hand, long-term concerns about reputation losses reduce the CRAs' temptation to issue favorable ratings [19,20]. A rise in market share increases the CRAs' concerns about long-term reputation losses [21]. Besides, open access for foreign investors should highlight the informational role of CRAs in bridging the informational gap in the financial market [4]. Some studies also proved that Chinese credit ratings carried informational value [5,22,23].

Therefore, the validity and effectiveness of credit rating in China is still a controversial topic that needs further study. Up to now, the studies on bond rating changes mainly focus on developed financial markets, and less research has been done on emerging bond markets, especially for the Chinese bond market. The limited studies cannot provide enough information for us. This paper tries to explore some valuable conclusions for investors, portfolio managers, and regulators by studying the information content of bond rating transitions and testing the effectiveness and sustainability of credit rating in China. The event study is used to study the price effects of both downgrading and upgrading announcements for enterprise bonds traded in the Shanghai stock exchange. The reactions of bond prices before, on, and after the announcement day are analyzed to make clear whether the rating changes effectively transfer new information to the enterprise bond market or not, to what extent, and follow what kind of route. After that, the determinants of market response to the rating change announcements are investigated with cross-sectional regression to show what kind of factors may take effect during the process and the mechanism of the interaction. The similarities and differences between the results of this paper and those of other papers are compared to help people better understand the characteristics of the Chinese enterprise bond market.

The main contributions of this paper are as follows. First, although China's bond market is the second largest in the world, current academic attentions toward the Chinese bond market are still less. The findings of this paper may help investors and portfolio managers better understand China's bond market. Second, the results show that the effectiveness and sustainability of the market have improved over the years, and bond prices can react to changes in related information. Yet upgrades and downgrades announcements have an asymmetric effect on the prices. It makes sense for investors and portfolio managers to keep their eyes on the downgrading announcements to make a good investment decision. Third, the cross-sectional results tell the investors that they should pay more attention to the enterprise bonds that have been downgraded for several levels from initial ratings and consider adjusting their portfolios to reduce their risk exposure.

The remainder of this paper is organized as follows. Section 2 is a literature review. Section 3 empirically tests the effects of rating change announcements on enterprise bond prices. Section 4 analyzes the determinants of market response to rating change announcements. Section 5 discusses the results. Section 6 concludes the main findings.

2. Literature Review

Generally speaking, a lot of investigations into the influence of bond rating transitions have been done over the years. There are some studies that conclude that rating transition has no new information shown or that credit events are conditional. Katz [24] develops an event-oriented methodology for testing the efficiency of the bond market. He concludes that no anticipation exists prior to a public announcement of a rating change. After the rating change, there is a lag of six to ten weeks before the yield-to-maturity fully adjusts to the new rating classification. Weinstein [25] investigates whether bond rating changes contain new information by studying the bonds' prices during the time period surrounding the announcement of the change in ratings. He concludes that the rating changes cause no significant price change during or after the announcement and that adjustments in the market are made 18 to six months before the event. Thus, his study suggests that changes in ratings provide no new information. Wansley and Clauretie [26] find an insignificant market reaction when firms are listed on Standard & Poor's CreditWatch, and the ratings are subsequently affirmed. A significant market reaction is observed when a listing on CreditWatch is subsequently downgraded. Livingston and Zhou [27] examine the marginal impact of Fitch ratings on industrial and utility bonds and find that increased competition in the rating industry enhances the information efficiency of the bond market.

Certain studies indicate that both upgrading and downgrading have effects on bond markets. Hand et al. [28] use daily bond price data and find significant reactions to both downgrades and upgrades in a full sample. Afterward, Gailen and Warga [29] used monthly data and found that the bond market has significant responses to both downgrading and upgrading. Similarly, May [30] uses daily transaction data to study the information content of bond rating changes and finds that the abnormal bond returns over a two-day event window are statistically significant for both downgrade and upgrade. Binici et al. [31] find that low-rated bonds respond strongly both to upgrade and downgrade announcements transitioning. Hu et al. [16] observe significantly negative bond price reactions to rating downgrades and significantly positive reactions to upgrades.

The asymmetries in the responses of bond prices to upgrades and downgrades announcements have been found in the literature. Some researchers show a greater reaction to upgrades. For example, Hand et al. [28] find the market reaction to downgrades is insignificant, and the reaction to upgrades is significantly positive. Cantor and Packer [32], Ismailescu and Kazemi [33], and Finnerty et al. [34] find similar results that positive credit rating events have a greater impact on asset prices than negative events. In contrast, there are other researchers who find that rating upgrading has far fewer effects. For example, Zaima and McCarthy [35] concluded that downgrades result in a significant effect while rating upgrades have very little effect. Gailen and Warga [29] find that the magnitude of downgrading effects increases dramatically as the sample moves from investment-grade to non-investment-grade firms. Upgrade effects are much weaker in magnitude and significance. Steiner and Heinke [36] examine daily excess Eurobond returns associated with announcement rating changes and find significant bond price reactions for downgrading and upgrading do not cause announcement effects. Alsakka and Gwilym [37] argue that negative credit announcements are typically more informative than positive ones. Binici et al. [31] find that bonds marginally above investment-grade status are particularly sensitive to downgrade announcements, while bonds marginally below investment-grade status are especially sensitive to upgrade announcements.

Above all, the mixed conclusions on the effect of rating changes announcement on the bond market suggest that whether bond rating changes contain new information or not still needs to be explored, and studies on different bond markets may have different

results. Although the development of the Chinese bond market is moving quickly, academic attention to it is still less. Moreover, no studies focus on enterprise bonds issued by state-owned enterprises (SOEs) with full or partial government ownership. In general, the SOEs play a key role both in China's domestic economy for the promotion of key industries and in pursuit of the government's 'Go Global' policies and industrial goals [38,39]. In 2020, in line with the transition to registration-based issuance, China Central Depository & Clearing Co., Ltd. (CCDC) accepted enterprise bond issuance applications of RMB1.5 trillion [40]. It is a market that cannot be ignored. Credit rating agencies (CRAs) generally assign higher credit ratings to SOEs because of explicit and implicit government support [5]. Nonetheless, little research is present as to whether SOEs' relatively favorable ratings are valid or not. Given that SOE bonds constitute a dominating proportion of publicly issued bonds, the "government ownership induced ratings inflation" hypothesis obtains further support. Bonds issued by state-owned enterprises (SOEs) have relatively poorer rating quality than their non-SOE peers [10].

Therefore, this paper studies the influence of rating change announcements on the price of fixed-income enterprise bonds traded in the Shanghai stock exchange to test whether the rating change announcements transfer effective information to the market and whether the development of the credit rating industry is sustainable in the long run. At the same time, the specific characteristics of the Chinese enterprise bond market and the factors which may take effect during the information transfer process are also explored. Sustainable development encompasses many economic and social aspects [41]. Understanding how these systems work can better control them for purposes of sustainable development [42]. Based on the analysis, some useful suggestions and beneficial recommendations are given to the investors and portfolio managers for their investment in China. Section 3 empirically tests the effects of downgrading and upgrading announcements on bond prices.

3. Empirical Test on the Effects of Rating Change Announcement

3.1. Theoretical Analysis and Hypothesis

According to Hollos [43], the value of the bond should equal the mathematical expectation of X. The expectation of X for a bond with N coupon payments can be expressed as:

$$E[X] = C\sum_{k=1}^{N}(p/d)^k + RF(1-p)\sum_{k=0}^{N-1}(p/d)^k + F(p/d)^N \quad (1)$$

where

F = face value of the bond
C = coupon payment
I = C/F = coupon interest
R = recovery rate = [0,1]
f = risk-free interest rate
d = 1/(1 + f) = discount factor
k = the number of coupon payment

Equation (1) shows that the default rates are very important for the determination of bond prices. Generally speaking, different bonds with different credit ratings have different default rates. Table 1 shows the average one-year global corporate transition matrices from 1981 to 2021. It shows that corporate bonds with lower credit ratings have a bigger default probability in the next year. An efficient bond market is one in which prices reflect all new information available [44], and announcements should lead to price changes in assets related to the announcements [45]. Therefore, if credit ratings changes are informative, a significant price reaction would be expected.

Table 1. Average One-Year Global Corporate Transition Matrix (1981–2021) (%).

	AAA	**AA**	**A**	**BBB**	**BB**	**B**	**CCC/C**	**D**	**NR**
AAA	87.09	9.05	0.53	0.05	0.11	0.03	0.05	0.00	3.10
AA	0.48	87.32	7.72	0.46	0.05	0.06	0.02	0.02	3.88
A	0.02	1.56	88.73	4.97	0.25	0.11	0.01	0.05	4.29
BBB	0.00	0.08	3.19	86.72	3.48	0.42	0.09	0.15	5.86
BB	0.01	0.02	0.10	4.52	78.12	6.66	0.53	0.60	9.43
B	0.00	0.02	0.06	0.15	4.54	74.73	4.81	3.18	12.51
CCC/C	0.00	0.00	0.00	0.07	0.13	2.53	43.91	26.55	15.39

Sources: Standard & Poor's, 2022; NR: no rating [46].

Above all, the hypothesis is established as follows:

Hypothesis 1 (H1). *Credit rating changes cause significant bond price reactions.*

3.2. Empirical Test

This paper uses an event study to test the price effects of rating transitions for enterprise bonds traded in the Shanghai stock exchange in China. Enterprise bonds are different from corporate bonds prevailing in developed financial markets, which are issued by state-owned corporations and are an important part of China's bond market. In the analysis, the daily abnormal bond return is

$$AR_{\mathrm{it}} = R_{it} - NR_{it} \tag{2}$$

where

$NR_{it} = \frac{1}{T}\sum_{s=T_1}^{T_2} R_{is}$

R_{is} is the daily return of bond i on day s, $\mathrm{T} = \mathrm{T}_2 - \mathrm{T}_1 + 1$ is the estimation period.

The average abnormal return on day t is:

$$AAR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{it} \tag{3}$$

where N is the number of enterprise bonds.

The cumulative abnormal return of bond i is:

$$CAR_i = \sum_{t=t_1}^{t_2} AR_{it} \tag{4}$$

where $t = t_2 - t_1 + 1$ is the length of the event window.

The cumulative average abnormal return is:

$$CAAR = \frac{1}{N}\sum_{i=1}^{N} CAR_i \tag{5}$$

For every event window, the null hypothesis 'abnormal return equals zero' is tested to examine whether credit rating changes have significant influences on bond prices and to what extent they are affected. The data for the analysis are drawn from the Wind Financial Terminal dataset, and the criteria for the selection of the sample are as follows. First, we screened all enterprise bonds traded in the Shanghai stock exchange, which experienced downgrades and upgrades by the end of December 2021. We found that many enterprise bonds are traded less or even have zero transactions, and these samples were moved out of the analysis. Second, as the event study analyzes the daily price data before and after the credit rating, the enterprise bonds which has no daily transaction data before and after the credit rating are continued to be removed. Third, the bonds which have continuous

rating changes during the estimation period were also removed from the sample to avoid affecting the estimation results. After the screening process, the sample size to be analyzed for downgrading and upgrading is 23 and 58, respectively. Most of the bond issuers are from the leasing and commercial service industry, followed by the manufacturing industry.

According to Peterson [47], typical lengths of the estimation period range from 100 to 300 days for daily studies. Considering the availability of the data, the length of the estimation period in the analysis is 120 days. The length of the event period is seven days (Day −3 to +3), where Day 0 is the announcement date of the rating change provided by the credit rating agencies.

3.2.1. Empirical Test on Downgrading Announcement

Table 2 reports the AARs and CAARs and the results of the empirical tests for the samples of downgrades. It shows that downgrades announcements have significant effects on bond prices before and after the announcement is released. The Corrado rank test and sign test give us almost the same results. The mean cumulative abnormal returns over days 0 and +1, over days 0 and +2, and over days 0 and +3 are all negative and statistically significant. The results illustrate that the event of downgrades does transmit new information to the bond market and results in a negative influence on bond prices. The effects are not shown all at once but take some time.

Table 2. Enterprise bond market response to downgrading announcement.

	AARs	CAARs	Rank stat.	Signed stat.
−3	−0.005	−0.005	−2.054 **	−2.294 **
−2	−0.001	−0.006	−2.092 **	−2.294 **
−1	0.002	−0.004	−0.791	−1.025
0	0.002	−0.002	−0.951	−0.602
1	−0.031	−0.033	−2.087 **	−3.986 ***
2	−0.020	−0.052	−2.832 ***	−3.986 ***
3	0.009	−0.044	−2.983 ***	−3.986 ***

*** $p < 0.01$, ** $p < 0.05$.

On the announcement day, the CAAR is statistically insignificant. What should be noticed is that, based on the results from Table 3, the mean cumulative abnormal returns over days −3 and −3 and over days −3 and −2 are negative and statistically significant, too, showing that the downgrading has been partially anticipated by the bond market before the announcement of rating report.

Table 3. Enterprise bond market response to downgrading announcement on each stage.

	CAARs	Rank stat.	Signed stat.
[−3, 3]	−0.044	−2.983 ***	−3.9855 ***
[−2, 2]	−0.048	−2.184 **	−3.140 ***
[−1, 1]	−0.027	−0.986	−1.871 *
[−3, −3]	−0.005	−2.054 **	−2.294 **
[−3, −2]	−0.006	−2.092 **	−2.294 **
[−3, −1]	−0.004	−0.791	−1.025
[−2, −1]	0.000	0.484	−0.602
[−3, 0]	−0.002	−0.951	−0.602
[−2, 0]	0.003	0.088	−0.179
[−1, 0]	0.004	0.747	0.244
[0, 0]	0.002	−0.533	−1.025
[0, 1]	−0.029	−2.332 **	−2.294 **
[0, 2]	−0.048	−3.215 ***	−3.140 ***
[0, 3]	−0.039	−3.262 ***	−3.140 ***
[1, 2]	−0.050	−3.561 ***	−3.563 ***
[1, 3]	−0.042	−3.459 ***	−3.563 ***

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 3 reports the seven days, five days, and three days CAARs and the results of the empirical tests before and after the downgrades. What should be noticed is that both the Corrado rank test and sign test are significant for seven days and five days CAARs, while for three days CAARs, only the sign test is significant at a 10% level. CAAR[−3, −1], CAAR[−2, −1], CAAR[−3, 0], CAAR[−2, 0], CAR[−1, 0], and CAAR [0, 0] are statistically insignificant, showing that there are no statistically significant abnormal price changes on both the announcement day and the day before the announcement of downgrading. Therefore, it may conclude that the downgrading event has been partially anticipated by the bond market before the announcement of the downgrades. There are no statistically significant abnormal price changes seen on both the announcement day and the day before the announcement of the downgrading, indicating that although the downgrades have been forecasted by the market, the rating information might not have been leaked out before the announcement was released. From Table 3, we can also see that downgraded bonds experience significantly negative abnormal bond returns in the days after the announcement of downgrading, indicating the effective information transfer of rating downgrades toward the market.

3.2.2. Empirical Test on Upgrading Announcement

To test the effects of credit rating upgrading announcements on the price of enterprise bonds, we used the *t*-test, Patell Z test, and BMP test. According to the statistical test results, credit rating upgrading announcements have a statistically insignificant impact on bond prices, and all the statistical tests have the same results (see Table 4).

Table 4. Enterprise bond market response to upgrading announcement.

	AARs	**CAARs**	***t* stat.**	**Patell Z stat.**	**BMP stat.**
−3	0.000	0.000	0.014	−0.002	−0.004
−2	−0.000	−0.000	−0.131	−0.135	−0.261
−1	0.000	0.000	0.018	−0.127	−0.233
0	0.001	0.001	0.189	0.047	0.094
1	0.002	0.003	0.668	0.240	0.29
2	0.002	0.005	1.091	0.868	1.207
3	−0.001	0.004	0.750	0.706	1.000

The same conclusions are drawn from further analyses of the abnormal returns before and after the upgrading announcement. Almost all average abnormal returns are statistically insignificant. The results are shown in Table 5. Above all, an upgrading event has not transferred obvious new information to the enterprise bond market and has not resulted in a statistically significant cumulative influence on bond prices.

Overall, rating downgrades announcements transfer new information to the bond market. In Section 4, the determinants of the bond market response to the rating downgrades are explored.

Table 5. Enterprise bond market response to upgrading at each stage.

	CAARs	*t* stat.	Patell Z stat.	BMP stat.
[−3, 3]	0.003	0.750	0.706	1.000
[−2, 2]	0.004	1.189	0.952	1.432
[−1, 1]	0.002	0.970	0.420	0.567
[−3, −1]	0.000	0.018	−0.127	−0.233
[−2, −1]	0.000	0.012	−0.154	−0.244
[−3, 0]	0.001	0.189	0.047	0.094
[−2, 0]	0.001	0.210	0.056	0.106
[−1, 0]	0.001	0.398	0.202	0.378
[0, 0]	0.001	0.346	0.314	0.712
[0, 1]	0.002	1.034	0.535	0.681
[0, 2]	0.003	1.525	1.355	1.896 *
[0, 3]	0.003	0.977	1.044	1.640
[1, 2]	0.003	1.623	1.437	1.845 *
[1, 3]	0.002	0.928	1.024	1.593

* $p < 0.10$.

4. Determinants of Market Response to Rating Change Announcement

According to the empirical tests in the last section, rating downgrading announcement has transferred new information to the bond market and has a negative effect on bond prices. In this section, the determinants of bond market response to the rating downgrades are explored to help investors or portfolio managers better understand the enterprise bond market in China.

4.1. Theoretical Analysis and Hypothesis

As per the previous analysis, negative abnormal returns precede rating downgrades, showing that the downgrades are not entirely surprising. This conclusion is consistent with that of May [30]. In an efficient market, all of the price adjustments associated with a downgrade that is fully anticipated should occur before the downgrade is announced. A downgrade that is largely a surprise to the market, though, should be associated with zero or positive returns before the downgrade and a largely negative response at the announcement of the downgrade. The same line of reasoning can be applied to upgrades. Hence, a stronger response to downgrades (upgrades) that are preceded by zero or positive (zero or negative) abnormal bond returns is hypothesized [30].

Usually, the credit rating of a bond is the most widely used measure of its credit quality. Table 6 shows the cumulative distribution of defaulters by a timeline of default count based on the original rating. The lower is the original credit rating and the higher is the default probability of the bond. Lower-rated bonds are associated with stronger market responses than bonds with higher ratings [45]. From AAA to AA, until B, the number of grades that the rating decreases by indicates the deterioration of credit quality and will be accompanied by a larger default probability. So it may be predicted that the larger the number of grades that the rating is decreased from the pre-downgrade rating, the stronger will be the bond market's reaction and the bigger will be its effect on the changes in bond prices.

Table 6. Global Corporate Average Cumulative Defaults (%, 1981–2021).

	AAA	AA	A	BBB	BB	B	CCC/C
1-year	0.0	0.0	0.0	1.1	5.8	33.1	60.1
3-year	0.0	0.1	0.5	2.5	13.5	57.3	26.1
5-year	0.0	0.2	0.7	3.8	16.5	60.8	18.1
7-year	0.1	0.3	1.2	4.5	17.9	60.8	15.3
Total	0.3	1.0	3.2	7.1	20.9	55.7	11.9

Source: Standard & Poor's [46].

According to a study by Sun and Jiang [48], the credit rating transition of bonds from different industries has different characteristics and is affected by the general business situation of the whole industry. Based on the global corporate default rates by industry given by Standard and Poor's (Table 7), different industries had different default rates. These results suggest that the rating downgrades of bonds from different industries may have a different impact on the changes in bond prices.

Table 7. Global Corporate Default Rates By Industry (%).

	2021	2020	Weighted Average (1981–2021)	Median
Aerospace/automotive/capital goods/metals	0.61	1.54	2.00	1.39
Consumer/service	1.66	6.44	2.42	1.81
Energy and natural resources	2.31	9.74	3.40	1.90
Financial institutions	0.22	0.30	0.62	0.33
Forest and building products/homebuilders	1.13	1.18	2.35	1.41
Health care/chemicals	0.58	2.39	1.39	0.88
High tech/computers/office equipment	0.30	2.08	1.20	1.00
Insurance	0.00	1.12	0.27	0.17
Leisure time/media	1.23	6.36	3.26	2.10
Real estate	1.35	2.28	0.79	0.00
Telecommunications	1.44	2.87	2.48	0.92
Transportation	2.53	3.72	2.02	1.86
Utility	0.16	0.48	0.43	0.17

Sources: Standard & Poor's [46].

Above all, the hypotheses are as follows:

Hypothesis 2 (H2). *Downgrades announcement preceded by abnormal bond returns results in a stronger market reaction.*

Hypothesis 3 (H3). *Downgrades announcement of previously lower-rated bonds results in a stronger market reaction.*

Hypothesis 4 (H4). *The number of grades that the rating is downgraded from the pre-downgrade rating has a negative effect on the bond prices.*

Hypothesis 5 (H5). *The rating downgrades of bonds from different industries may have a different impact on the changes in the bond price.*

The cross-sectional model is

$$CAR[t_1, t_2]_i = \alpha_0 + \alpha_1 CAR[-3, -1]_i + \alpha_2 oldrating_i + \alpha_3 \mathrm{degree}_i + \alpha_4 industryC_i + \alpha_5 industryL_i + \varepsilon_i \quad (6)$$

Here, CAR$[-3, -1] \geq 0$ is a dummy variable that is equal to one if the firm's cumulative abnormal bond return over Day -3 to Day -1 is greater than or equal to zero and is equal to zero otherwise.

Oldrating is a rating scale assigned to the pre-downgrade rating. (AAA = 1, AA+ = 2, AA = 3, AA− = 4, A+ = 5, A = 6, A− = 7, . . . , C = 19).

Degree is the number of grades that the rating is downgraded from the pre-downgrade rating. (degree = 1, 2, 3 . . .).

IndustryC is a dummy variable that is equal to one if the corporate is belonged to the manufacturing industry and is equal to zero otherwise.

IndustryL is a dummy variable that is equal to one if the corporate is belonged to the leasing and business service industry and is equal to zero otherwise.

4.2. Cross-sectional Results

The results for model (6) are shown in Table 8, which shows that the coefficient of IndustryC and IndustryL are statistically insignificant for all the equations, indicating that the rating downgrades of bonds from different industries have not shown different impacts on the changes of bond prices. Hypothesis 4 (H4) cannot be supported thereby. Variable IndustryC and IndustryL are removed from model (6), and model (7) is built as follows.

$$CAR[t_1, t_2]_i = \alpha_0 + \alpha_1 CAR[-3, -1]_i + \alpha_2 oldrating_i + \alpha_3 \text{degree}_i + \varepsilon_i \quad (7)$$

Table 8. Cross-sectional results.

	CAR[0, 1]		**CAR[0, 2]**		**CAR[0, 3]**	
	(6)	**(7)**	**(6)**	**(7)**	**(6)**	**(7)**
α0	0.076	0.089	0.131	0.150	0.101	0.111
	(2.633 **)	(3.317 ***)	(5.417 ***)	(5.083 ***)	(5.366 ***)	(5.202 ***)
CAR[−3,−1] ≥ 0	−0.032	−0.035	−0.042	−0.045	−0.026	−0.028
	(−1.391)	(−1.525)	(−1.446)	(−1.621)	(−1.215)	(−1.373)
Oldrating	−0.007	−0.015	−0.016	−0.023	−0.018	−0.022
	(−0.881)	(−1.717 *)	(−1.637)	(−2.534 **)	(−2.615 **)	(−3.568 ***)
Degree	−0.045	−0.050	−0.087	−0.092	−0.060	−0.063
	(−2.880 ***)	(−3.144 ***)	(−4.626 ***)	(−4.972 ***)	(−4.542 ***)	(−4.894 ***)
IndustryC	−0.051		−0.047		−0.030	
	(−1.637)		(−1.235)		(−1.041)	
IndustryL	−0.005		0.006		0.001	
	(−0.278)		(0.357)		(0.095)	
adjusted R2	0.484	0.464	0.656	0.658	0.647	0.662
F stat.	5.119 ***	7.340 ***	9.400 ***	15.140 ***	9.076 ***	15.355 ***
	CAR[1, 2]		**CAR[1, 3]**			
	(6)	**(7)**	**(6)**	**(7)**		
α0	0.127	0.149	0.096	0.109		
	(6.044 ***)	(5.265 ***)	(6.010 ***)	(5.436 ***)		
CAR[−3, −1] ≥ 0	−0.042	−0.045	−0.026	−0.028		
	(−1.565)	(−1.745 *)	(−1.380)	(−1.550)		
Oldrating	−0.015	−0.024	−0.018	−0.023		
	(−1.755 *)	(−2.753 **)	(−2.759 **)	(−4.007 ***)		
Degree	−0.085	−0.091	−0.059	−0.062		
	(−4.876 ***)	(−5.243 ***)	(−4.997 ***)	(−5.364 ***)		
IndustryC	−0.053		−0.035			
	(−1.375)		(−1.274)			
IndustryL	−0.007		0.002			
	(0.478)		(0.234)			
adjusted R2	0.685	0.674	0.696	0.694		
F stat.	10.573 ***	16.187 ***	11.092	17.648 ***		

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

The regression results of model (7) are shown in Table 8. We can see that both the coefficients of Oldrating and Degree are negative and statistically significant for all regressions: thereby, Hypotheses 2 and 3 (H2 and H3) are supported. It is shown that the price of bonds with lower ratings has stronger reactions to downgrade announcements, and the lower the initial rating, the stronger is the reaction to the announcement. Meanwhile, the higher the number of grades that the rating is downgraded from the pre-downgrade rating, the larger the negative effect that the downgrading announcement has on the bond prices. Furthermore, by comparing the coefficients of variable Oldrating and Degree, the absolute value of variable Degree's coefficient in all regressions is larger than that of variable Oldrating, indicating that the number of grades that the rating is downgraded from pre-downgrade rating has a larger negative effect on the changes of bond price, relative

to the influence of initial rating. The conclusions tell the bond investors and portfolio managers that they should pay more attention to the bonds which have been downgraded for several levels from initial ratings, and the adjustment of their investment portfolio might be considered. Moreover, except for the regression model for CAR[1, 2], all the coefficients of CAR$[-3, -1] \geq 0$ in other models are statistically insignificant, indicating that the abnormal bond returns preceding downgrades do not have an evident influence on the changes of bond prices. For all the regressions for model (7), the results show that all the random error is symmetrically distributed; so the Glejser test is done to test heteroskedasticity. None of the residual regression is significant, which indicates the hypothesis of heteroskedasticity is rejected. In Section 5, the discussions of the empirical results are conducted in detail.

5. Results Discussion

5.1. Discussion on the Information Effect of Downgrading Announcement

Based on the empirical results, the mean cumulative abnormal returns over days 0 and +1, over days 0 and +2, and over days 0 and +3 are all negative and statistically significant. It is shown that downgrades announcements have significant effects on bond prices after the announcement is released. The mean average abnormal returns on day1 to day3 are −0.031, −0.020, and 0.009, respectively. The results indicate that the announcement does transfer new information to the bond market and results in a significantly negative influence on bond prices. Therefore, for credit downgrading, the empirical results support hypothesis H1. This conclusion is consistent with Dhawan and Yu [23] and Livingston et al. [5]. They examine the relationship between Chinese corporate bond yields and credit ratings, showing that Chinese bond ratings are informative of corporate bond yields, with lower-rated bonds having significantly higher yields. The immediate large change in bond prices after the announcement shows that the market is very sensitive to negative rating change information. With China showing new momentum in tightening the discipline of its domestic credit rating agencies and starting to allow SOEs to default in more recent times [4], the credit risk of enterprise bonds cannot be ignored.

The CAAR is statistically insignificant on the downgrades announcement day. Not only that, CAAR[−3, −1], CAAR[−2, −1], CAAR[−3, 0], CAAR[−2, 0], CAR[−1, 0] and CAAR[0, 0] are all statistically insignificant, indicating that there are no statistically significant abnormal bond price changes on both the announcement day and the day before the announcement of downgrades. Moreover, the price reaction was most intense on the second day of the rating announcement. All of these results indicate that the rating information might not have been leaked out before the announcement was released. This a good signal that with the Chinese regulators adopting a strict approach to deal with the defects of the rating industry and the bond market by imposing heavy sanctions on the unscrupulous CRAs [4], the sustainability of the industry and the bond market has been reinforced.

5.2. Discussion on the Information Effect of Upgrading Announcement

According to the empirical results of upgrading, all the mean cumulative abnormal returns before, on, and after the upgrading are insignificant, indicating the upgrades announcements have a statistically insignificant impact on bond prices. The results show that the upgrading event has not transferred obvious new information to the enterprise bond market. This conclusion is not consistent with Hu et al. [16], which found significantly positive reactions to rating upgrades. The reason might be that the sample analyzed by Hu et al. [16] includes nonfinancial medium-term notes and corporate bonds, resulting in a different empirical result, while enterprise bond has specific features and the analysis results shows different. The enterprise bonds issue by state-owned enterprises with full or partial government ownership, and the initial ratings are usually investment grade.

The reason might be as follows. First, the ownership-related conflicts of interest created by the existence of common state ownership by both a domestic rating agency and a domestic Chinese firm might be expected to provide higher ratings to state-owned firms [18].

Second, the issuer-paid model gives CRAs incentives to allocate more favorable ratings to customers who have larger bond issuances or are repeat issuers [49,50]. Jiang et al. [13] found that Standard & Poor's ratings were higher after it adopted an issuer-paid model, suggesting that the issuer-paid model leads to rating inflation. Third, the Chinese credit rating industry is more competitive. Compared with Moody's, S&P, and Fitch, which account for almost 95% market share in the global bond markets, the largest three Chinese CRAs account for only 75% of the Chinese domestic market [9]. The competition in the rating industry may lead to more inflated ratings [51]. As competition increases, the quality of all credit ratings issued by agencies declines, and lower quality ratings are, on average, higher ratings [18]. CRAs may selectively reveal the content of private information depending on market competition [52].

Hite and Warga [29] found that most of the effects caused by upgrades are insignificant, but rating changes from speculative grade to investment grade lead to positive abnormal returns. In this paper, all of the upgrading enterprise bonds are upgraded from one investment grade to another investment grade, and the adjustment range is also very small, such as upgrading from AA to AA+ and from AA+ to AAA. Therefore, the market is not sensitive to rating changes, and the bond price keeps almost unchanged.

5.3. Discussion on the Determinants of Market Response to Downgrading

The empirical results show that the abnormal bond returns preceding downgrades do not have a statistically evident influence on the changes in bond prices, and the rating downgrades of bonds from different industries have not shown a different impact on the changes in bond prices, so hypotheses 2 and 5 (H2 and H5) cannot be supported. The bond prices not being sensitive to abnormal bond returns indicate the Chinese enterprise bond market is an efficient market. In an efficient market, the price adjustment associated with the downgrade is anticipated [30], as testified in Section 3. It is shown that the mean cumulative abnormal returns over days -3 and -3 and over days -3 and -2 are negative and statistically significant. For the test result of H5, the reason might be that most of the enterprise bonds belonged to the manufacturing industry or leasing and business service industry with full or partial government ownership. Due to the same ownership background, there is no significant difference in bond performance due to the different industries.

According to the results, hypotheses 3 and 4 (H3 and H4) are supported. The price of bonds with lower ratings have stronger reactions to downgrade announcements than the effects for higher rated ones, and the lower the initial rating, the stronger is the reaction to the announcement. This conclusion is similar to that of May [30]. Meanwhile, the higher the number of grades that the rating is downgraded from the pre-downgrade rating, the larger the negative effect that the downgrading announcement has on the bond prices. Comparatively, the negative impact of the downgrading levels on the price is greater. This conclusion is different from that of May [30], which concludes that the number of rating decreased grades has no significant effect on bond prices. The Chinese enterprise bond prices respond much more positively to the downgrading levels than might be explained by the situation that CRAs generally assign higher credit ratings to enterprise bonds [5,53]. Therefore, multiple downgrade levels indicate even greater credit risk and cause a stronger market response.

6. Conclusions

This paper studies the effects of rating change announcements on the price of fixed-income enterprise bonds in China to test whether the rating change announcements transfer effective information to the market, whether the credit rating industry is sustainable in the long run, and what kind of factors may take effect during the process. The main conclusions are drawn as follows.

First, upgrades and downgrades announcements have an asymmetric effect on enterprise bond prices, indicating that downgrades announcements have transferred new

information to the financial market and result in a statistically significant negative effect, yet upgrades announcements do not have a statistically obvious effect on bond prices. The reason for the result may be that the Chinese bond market is a government-led market system and has set a strict threshold for bond issues. The initial rating of a bond is usually above investment grade, so once the track rating report releases negative news, the market reaction may be very strong. This phenomenon has been verified in the analysis of this paper. Investors investing in the Chinese enterprise bond market should pay more attention to the downgrading announcements of enterprise bonds, which may have a negative impact on the returns of their investment based on the conclusion of this paper.

Second, results show that the downgrading event has been partially anticipated by the bond market before the announcement of the downgrades. There are no statistically significant abnormal price changes seen on both the announcement day and the day before the announcement of the downgrading, indicating that although the downgrades have been forecasted by the market, the rating information might not have been leaked out before the announcement was released. This result indicates that with the Chinese regulatory authorities strengthening their supervision of the financial market and the credit rating agencies, the pricing function of credit rating has taken effect, and the efficiency of the Chinese bond market will be improved more with further standardization of credit rating business and information exposure in China. China has issued a circular to promote the development of credit rating businesses in the bond market to facilitate the healthy growth of the market. The circular is jointly issued by the People's Bank of China, the National Development and Reform Commission, the Ministry of Finance, the China Banking and Insurance Regulatory Commission, and the China Securities Regulatory Commission. The circular requires these institutions to establish and use rating methodology systems that can achieve reasonable differentiation by the end of 2022 to effectively improve the quality of ratings [54]. According to Angerer et al. [55], financial reputation and accountability combined can effectively alleviate rating inflation and provide a powerful mechanism of control over rating agencies. Therefore, the strengthening of regulations and supervision of the Chinese government toward the credit rating industry may help reinforce the sustainability of the industry and the bond market.

Third, this research indicates that after the announcement of downgrades, the downgraded firms experience significantly negative abnormal bond returns, indicating that the event of downgrades does transmit new information to the bond market and results in a statistically negative influence on the bond prices, yet the effects are not shown on the bond price all at once. It takes some time for the market to react to the announcement. The results tell us that with the development of the Chinese bond market during these years, the effectiveness of the market has been improved to some extent, and bond prices can react to changes in related information. Therefore, it makes sense for investors and portfolio managers to keep their eyes on the rating changes announcement to make a good investment decision.

Fourth, the price of bonds with an initially lower rating have a stronger reaction to downgrades, and the higher the number of grades that the rating is downgraded from the pre-downgrade rating, the bigger the negative effect that the downgrading has on the bond prices. The cross-sectional results indicate that the market responses are more intense to unpredicted changes in ratings, which is especially the case for lower-rating bonds. Moreover, the number of grades that the rating is downgraded from the pre-downgrade rating has larger negative effect on the changes of bond price, relative to the influence of the initial rating. Investors investing in the Chinese enterprise bond market should pay more attention to the enterprise bonds that have been downgraded for several levels from initial ratings and consider adjusting their portfolios to reduce their risk exposure.

The study of this paper is helpful in understanding the Chinese enterprise bond market. Future research includes extending the analysis to corporate bonds and making multi-dimensional comparisons with the results of this article. Moreover, in May 2017, the Chinese government pledged permission for international CRAs to have direct access to the

Chinese domestic bond market [56]. In January 2019, the Chinese central bank started to allow global CRAs to operate independently in the Chinese rating industry [16]. The entry of internationally renowned CRAs would intensify competition and change the landscape of the Chinese rating market [4]. The information value of ratings will be enhanced, and capital market development will be fostered [18]. Years later, when the data are rich enough for academic research, it makes sense to perform a comparison between the early stage and the later stage. Hopefully, there might be more interesting findings.

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